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November 22, 2004

Authorized Officer Roberto Rábago
Mail Stop PCT, Attention: IPEA / US
Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313-1450

Re: Reply to First Written Opinion
International Application No.: PCT/US03/40916
Applicant: ExxonMobil Chemical Patents Inc.
Entitled "Polymers with New Sequence Distributions"
Filed: December 19, 2003
Our Reference: 2003B133C

Dear Examiner Rábago:

In response to the Written Opinion (herein Opinion) dated September 22, 2004, Applicants provide the following remarks and amendments. Claims 1-95 are before the Examiner. Claims 36-41 have been amended to correct typographical errors regarding claim dependencies. Replacement page 112 is provided herewith. There have been no amendments to the Specification.

In the Opinion, it stated that claims 1-82, 87-89, and 91-95 lack novelty under PCT Article 33(2) as being anticipated by each individually of U.S. Patent No. 2,548,415 ("Welch") (herein '415) and U.S. Patent No. 2,534, 698 ("Calfee") (herein '698) for the reasons stated in Section V. Applicants respectfully disagree.

The copolymers as claimed possess novel sequence distributions (contrast, for example, m values of claims 1 and 18) as described by a mathematical relationship. The mathematical relationship as set forth is between the measured values of F and A by the parameter m. The measured value F is defined as the measured isoolefin-diolefin-diolefin triad fraction in the copolymers. In particular, for example, the triad fraction may refer to an isobutylene-isoprene-isoprene (or BII)

comonomer sequence in the copolymer of isobutylene and isoprene as shown in the inventive examples of the application. This comonomer sequence was characterized by ^{13}C NMR (paragraph 00214 through 00220) by methods known to those skilled in the art with triad fractions assigned according to C. Corno, A. Proni, A. Priola, and S. Cesca in *Macromolecules* **1980**, *13*, 1092 and J.L. White, T.D. Shaffer, C.J. Ruff and J.P. Cross in Macromolecules **1995**, *28*, 3290 (see paragraph 00216). The value of A is defined as the measured molar ratio of the diolefin to the isoolefin in the copolymer. The A value is the molar ratio of isoprene to isobutylene in the copolymer and were determined by ^{1}H NMR (see paragraph 00213).

From the measured values of F and A, the parameter m is determined. The parameter m may be more accurately determined by preparing and analyzing copolymers of varying IP/IB ratios. The value of m from this kind of data may be determined by iterative curve fitting to obtain the best-fit solution. This type of analysis produces an average value for m that is not dependent on a single feed composition or a single IP/IB copolymer ratio and lessens the experimental variability in preparing monomer feeds and analyzing the copolymer. The m parameter has been determined by this method for examples 150 and 151 as well as comparative example 149. The m parameter may also be calculated for a single copolymer composition with knowledge of the F and A values for the copolymer in question. This approach was used to determine m for example 152.

The determination of the BII triad fraction (known as F in the application and as described above) in isobutylene-isoprene copolymers is currently practiced today, however, the sequence distribution and triad fraction values were not directly accessible before about 1980. As such, as the Opinion pointed-out, the cited '415 and '698 patents do not specifically state the BII fraction or F value for their respective copolymers. However, triad fractions may be reasonably estimated from copolymer probability statistics with knowledge of the molar fractions of comonomers in the feed and the mole fractions of the comonomers in the copolymer. These two sets of values are mathematically linked through a generally useful form of the well known copolymer equation (see, for example, F.A. Bovey, Chain Structure and Conformation of Macromolecules, Academic Press, New York, 1982, page 127):

$$F_1 = \frac{r_1 f_1^2 + f_1(1-f_1)}{r_1 f_1^2 + 2f_1(1-f_1) + r_2(1-f_1)^2}$$

In this equation, experimental data is used for F_1, the mole fraction of comonomer 1 in the copolymer (isoprene), and f_1, the mole fraction of isoprene in the feed. The letter designations should not to be confused with the definition of F (or the BII triad fraction) in the current application. The values of r_1 and r_2 are the reactivity ratios of monomer 1 (isoprene) and

monomer 2 (isobutylene). The experimental data is plotted on an X-Y plot with f_1 on the X-axis and F_1 on the Y-axis. The equation is solved by trial-and-error choice of r_1 and r_2 so as to fit the curve to the experimental data. The value of r_1 determined by this method is essentially the value of m.

For the '415 patent, one monomer feed ratio is essentially used for all examples. Examples are generated for both batch and continuous operation. Since all the data is generated for one feed composition, an average value for the isoprene incorporation (1.49) is used to solve for r_1 (or the m parameter) in order to reduce error in the single-point estimate. The value for m using this procedure is 1.1. The '698 patent presents only one example with isoprene incorporation data. The estimate of the m parameter is 1.0. As such, Applicants respectfully submit that the claimed copolymers are not anticipated in light of '415 and '698 and request that the rejections be withdrawn.

Applicants thank the Examiner for the indication that claims 83-86 and 90 meet the criteria set out in PCT Article 33(2)-(3). Applicants also thank the Examiner for the indication that claims 1-95 meet the criteria set out in PCT Article 33(4). Applicants respectfully request a favorable Examination Report.

Applicants invite the Examiner to telephone the undersigned attorney if there are any other issues outstanding which have not been presented to the Examiner's satisfaction.

Very truly yours,

Leandro Arechederra III

35. A copolymer produced by the process comprising contacting an isoolefin, preferably isobutylene, a multiolefin, one or more Lewis acid(s), one or more initiator(s), and a diluent comprising one or more hydrofluorocarbon(s) (HFC's); the copolymer having a copolymer sequence distribution defined by:

$$F = m A / (1 + mA)^2$$

wherein **m** is the copolymer sequence distribution parameter; **A** is the molar ratio of multiolefin to isoolefin in the copolymer; and **F** is the isoolefin-multiolefin-multiolefin triad fraction in the copolymer; wherein m is from greater than 1.5 or m is from 1.10 to 1.25.

36. The copolymer of claim 35, wherein m is from greater than 2.0.

37. The copolymer of claim 35, wherein m is from greater than 2.5.

38. The copolymer of claim 35, wherein m is from greater than 3.5.

39. The copolymer of claim 35, wherein m is from 1.15 to 1.20.

40. The copolymer of claim 35, wherein m is from 1.15 to 1.25.

41. The copolymer of claim 35, wherein m is about 1.20.

42. The copolymer of claim 35, wherein the multiolefin is a conjugated diene, preferably isoprene.

43. The copolymer of any of claims 35-42, wherein the multiolefin content is from greater than 0.5 mol%.